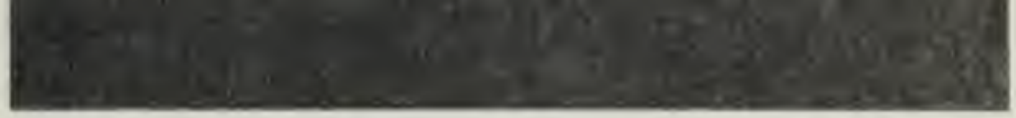


DEPARTMENT OF AGRICULTURAL ECONOMICS
UNIVERSITY OF ILLINOIS
AGRICULTURAL EXPERIMENT STATION

ILLINOIS AGRICULTURAL ECONOMICS

ARTICLES IN THIS ISSUE:

JANUARY, 1963
VOLUME 3, NUMBER 1

Although fertilizer use in Illinois has increased rapidly, less than one-half of the total harvested acreage is fertilized. One obstacle to the use of fertilizer is the large number of alternatives that need to be analyzed in the choice of a program. While the purely technical data on fertilizer requirements and crop response are essential to spell out the range of possible programs, the choice is ultimately an economic one. In the first article an economic comparison is made between programs based on the concept of nutrient "buildup" and maintenance and those programs that emphasize fertilization of crops for specific yields.

The second article reports the results of a comparison of the food budgets of Illinois families with those of families in Canada, the United Kingdom, and the Union of South Africa. Since the kinds of foods making up the food budget are likely to depend on the family's income level, the international comparisons were made at three different income levels. The food budget data for the Illinois families came from 1,144 housewives who were members of units sponsored by the Cooperative Extension Service.

An important aspect of the current debate on taxation in Illinois is the nature of the incidence of the tax burden on Illinois farmers as compared with that on other groups in the economy. Tax reform is almost certain to alter this incidence in one direction or the other. The third article in this issue describes the economic basis of the property tax on farm property in terms of the income-producing nature of farm assets. Comparisons are made of the Illinois farm property tax with those of other states as well as with that for other groups in Illinois.

The water resources of Illinois are being used at an increasing rate. This poses economic problems for both public and private users. A variety of government units are charged with protecting the public interest in water use. The fourth article focuses attention on these agencies and the laws which pertain to surface water use in the fringe area between municipalities and farming areas. The author reviews these for the purpose of pointing out the present inadequacies for handling problems of drainage and flood control in the fringe area.

The two preceding issues of ILLINOIS AGRICULTURAL ECONOMICS have carried articles relating developments in Western Europe to United States exports. The final article in this issue presents the results of statistical analyses of the effect of selected factors on the imports of foodstuffs into Western Europe. The analysis indicates that the United States has not benefited to the same relative extent as its competitors in the expanding Western European food market.

ILLINOIS AGRICULTURAL ECONOMICS

Rates of Return on Fertilizer — A Comparison of Buildup and Maintenance Programs[1]

R. E. WEST and W. N. THOMPSON

SOME COMMERCIAL FERTILIZERS have been used in Illinois for many years, but heavy use of such fertilizers is a recent development. Illinois farmers used about ten times as much commercial fertilizers in total tons in 1950 as they did in 1940. On a nutrient basis, use of fertilizers nearly doubled in the 1950's. On most Illinois farms, fertilizers are a major cash-cost item in crop production, being second only to farm machinery costs. Farmers now realize that commercial fertilizer is needed on most of our soils to obtain economical yields unless large amounts of animal manures are available. But there are many questions about the selection of fertilizers, including the merits of heavy application of fertilizer to build up fertility as compared with fertilization on an annual basis. The decline in prices of important Illinois crops while costs have increased has made the question of rates of return on fertilizers applied in different ways an increasingly important one.

Objectives and Scope

The general objective of this study was to obtain information which would help farmers to use fertilizer in the most economical ways. The specific objectives were:

1. To determine the most economical fertilization program to increase and maintain yields of crops on depleted soils.

2. To determine the rate of return from application of given amounts of fertilizer on depleted soils with rotations typical of those in the area studied.

3. To determine the influence of type of rotation on the cost of and returns from improved fertility programs.

This study was limited to soils of central, north central, and northwestern Illinois that were formed primarily from deep or moderately deep loess (Fig. 1). One group included the following soil

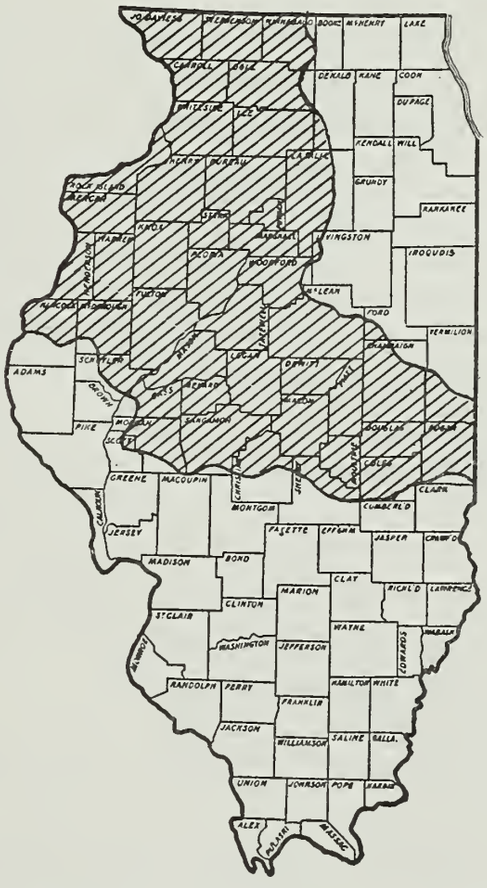


Fig. 1. — Area where study was made.

[1] This study is reported in more detail in Richard E. West's, "Costs and Returns of Fertilization Programs for Selected Illinois Soils," unpublished master's thesis, University of Illinois, 1962.

types: Muscatine silt loam, Sable silty clay loam, Flanagan silt loam, and Drummer silty clay loam; these are called "excellent" soils in this report. The second group included Fayette silt loam and Birkbeck silt loam, called "good" soils.

General Procedure

The budgeting method was used to compare the added costs and returns associated with four fertility programs designed to increase yields on the two groups of depleted soils. It was assumed that mineral levels, as shown by soil tests, were the same for both groups — 34 pounds (low minus test) for phosphorus according to the P_2 test and 130 pounds of potassium, and that 152 pounds of P_2O_5 and 170 pounds of K_2O were needed to attain potential yields. The potential yields and estimated yields on depleted soils for different crops are shown in Tables 1 and 4.

Added costs and returns are compared for three rotations over a ten-year period — Corn-Soybeans (C-Sb); Corn-Corn-Soybeans-Small grain[2] with legume catch crop (C-C-Sb-Sg(leg)); and Corn-Corn-Oats-Legume (C-C-O-L). Different rotations were used to determine whether the choice of crops has a substantial effect on the economics of choice of an improved fertility program for the two groups of soils. A ten-year period was chosen to determine the timing of costs and returns from the fertility programs and rotations over a period of years. All costs and returns were computed on a rotation-acre basis so that they may be easily compared.

The fertility programs. The costs and returns of four fertility programs were compared. Three of the programs were designed to attain the potential yields for the soils using the best technological methods, excluding irrigation. In the fourth program, sufficient fertilizer for only "moderate" yields was used. The four fertility programs were:

"Immediate buildup"—deficiencies of phosphorus and potassium as shown by soil tests are corrected in the first year, after which "maintenance" amounts are applied each year. Crop removals are used as the basis for determining maintenance requirements.

"Gradual buildup" — mineral deficiencies are corrected over a four-year period with sufficient supplementary fertilizers to attain yield potentials during the buildup period. Maintenance applications are made in succeeding years.

"Fertilization of the crop for high yields" — fertilizers are applied in sufficient amounts to meet the needs of each crop in the rotation without correcting the mineral deficiencies as shown by soil tests.[3]

Table 1. — Estimated Yields Without and With Fertilizer, Excellent Illinois Soils[a]

Crop	Potential yield[b]	Depleted soils, percent of potential yield[c]	Depleted soils, yield	Yield increase with fertilizer for potential yields[d]
Corn.....	104 bu.	60	62 bu.	42 bu.
Soybeans..	39 bu.	68	27 bu.	12 bu.
Oats.....	79 bu.	73	58 bu.	21 bu.
Wheat.....	45 bu.	52	23 bu.	22 bu.
Hay.....	4.0 tons	46	1.8 tons	2.2 tons

[a] Average for Muscatine silt loam, Sable silty clay loam, Flanagan silt loam, and Drummer silty clay loam.
[b] From Agronomy Fact Sheet SP-19, University of Illinois, Department of Agronomy. "Potential yields" represent expected 10-year average yields using the best technological methods, excluding irrigation.
[c] Computed from "percentage sufficiency" tables of R. H. Bray, University of Illinois, Department of Agronomy Mimeo AG 1198.
[d] Yield increases for "moderate" yields were estimated as follows: corn, 22 bu.; soybeans, 5 bu.; oats, 7 bu.; wheat, 14 bu.; and hay, 1.4 tons.

[2] Assumed to be one-half oats and one-half wheat.

[3] Fertilizer requirements are based on work of R. H. Bray, L. J. McKenzie, and R. T. Odell, University of Illinois, Department of Agronomy. Amounts of mineral elements returned to soils in fertilizers do not fully replace amounts removed by crops.

"Fertilization of the crop for moderate yields" — fertilizers are applied in amounts to attain yields approximately one-half of the potential yield increase.

Sufficient nitrogen is applied in all fertility programs to attain the yield goals. Nitrogen requirements differ for the various crops. For corn it is assumed that 2 pounds of nitrogen are required per bushel of increase above the yield at the depleted level. It is assumed that 30 pounds of nitrogen are required per acre of oats or wheat to obtain high yields and 15 pounds per acre for moderate yields. No nitrogen is applied to soybeans and hay crops. It is estimated that 40 pounds of nitrogen are added to the soil by the legume catch crop or hay crop.

Fertilizer costs. The prices used in computing costs of the fertility programs were: nitrogen, 12.2 cents; P_2O_5, 7.8 cents for the immediate buildup program and 9.5 cents for the other programs; K_2O, 3.8 cents for immediate buildup and 4.5 cents for the other programs; and $2.00 per acre spreading charge for the straight materials used in the immediate buildup program. Lower costs for minerals were used for the immediate buildup program than in the other programs because straight materials, a commonly used source, are a less expensive source of minerals than mixed fertilizers. Prices of ten commonly used fertilizers were obtained from three central Illinois fertilizer dealers as a basis for determining prices to be used in this study. A price for each nutrient was computed by weighting each of the ten fertilizers according to the amounts sold in Illinois during the first half of 1960.[4]

Other costs. Other costs in addition to costs of fertilizers are incurred as yields are increased — added costs for seed, harvesting, and improved practices. Costs used in this study per added bushel were: corn, 5 cents; soybeans, 8 cents; oats, 3 cents; wheat, 6 cents; and hay $1.60 per ton.[5]

Crop prices. The value of the added crop due to the improved fertility programs and associated practices was computed by applying the following prices to the increased yields: corn, $1.10 per bushel; soybeans $1.90 per bushel; oats, $.55 per bushel; wheat, $1.65 per bushel; and legume hay, $16.00 per ton.[6]

Added Returns and Costs — Excellent Soils

Returns and costs. The value of the added returns resulting from the improved fertility programs was the same for the two buildup programs and the program in which crops were fertilized for high yields (Table 2), on the assumption that the same yields can be attained with each of the three programs. The added values of crop production per year for the three rotations were: C-Sb, $34.50; C-C-Sb-Sg(leg), $34.78; C-C-O-L, $34.79. The added values of crop production per year were substantially less for the fertilizer program in which crops were fertilized for moderate yields: $16.85 for the C-Sb rotation; $16.84 for the C-C-Sb-Sg(leg) rotation; and $18.66 for the C-C-O-L rotation.

Among the four fertility programs, added costs were highest during the first year for the immediate buildup program because all fertilizer buildup costs were incurred in this year. Under the gradual

[4] Fertilizers were 33-0-0, 82-0-0, 20-0-0, 0-20-0, 0-46-0, 0-0-60, 10-10-10, 5-20-20, 12-12-12, and 4-16-16. Illinois fertilizer sales data were obtained from L. T. Kurtz and N. G. Pieper, "Fertilizers, Fertilizer materials, and Rock Phosphate sold in Illinois, January 1, 1960 to June 30, 1960" University of Illinois, Department of Agronomy, AG-1855, September, 1960.

[5] Based on results of detailed cost studies of the University of Illinois Department of Agricultural Economics.

[6] From R. A. Hinton, "Farm Management Manual," University of Illinois, Department of Agricultural Economics, AE-3349, May, 1959.

Table 2. — Added Annual Crop Value and Fertilizer Costs per Rotation Acre by Years for Four Fertility Programs, Excellent Illinois Soils[a]

	Fertility program			
	Immediate buildup	Gradual buildup	Fertilize crops for high yields	Fertilize crops for moderate yields
Corn-Soybeans				
Added crop value	$34.50	$34.50	$34.50	$16.85
Fertilizer costs[b]				
1st year	$26.98	$17.11	$ 9.85	$ 4.28
2nd–4th years	11.59	17.11	9.85	4.28
5th–10th years	11.59	11.59	9.85	4.28
10–year average	13.13	13.80	9.85	4.28
Corn-Corn-Soybeans-Small grain (legume)				
Added crop value	$34.78	$34.78	$34.78	$16.84
Fertilizer costs				
1st year	$26.68	$16.21	$ 9.56	$ 3.59
2nd–4th years	10.69	16.21	9.56	3.59
5th–10th years	10.69	10.69	9.56	3.59
10–year average	12.29	12.90	9.56	3.59
Corn-Corn-Oats-Legume				
Added crop value	$34.79	$34.79	$34.79	$18.66
Fertilizer costs				
1st year	$27.23	$17.31	$10.58	$ 4.16
2nd–4th years	11.78	17.31	10.58	4.16
5th–10th years	11.78	11.78	10.58	4.16
10–year average	13.32	13.99	10.58	4.16

[a] Average for Muscatine silt loam, Sable silty clay loam, Flanagan silt loam, and Drummer silty clay loam.

[b] Includes added variable costs in addition to fertilizer.

buildup program, fertilizer costs were the same for the first four years, after which they declined to the same level as the costs of the immediate buildup program for the last six years of the ten-year period. The important distinction between the two buildup programs is the difference in the timing of the fertilizer costs during the first four years. The ten-year average cost of gradual buildup was somewhat higher than the costs under immediate buildup because mixed fertilizers were used as a source of minerals in the gradual buildup program, but straight materials were used as a source of phosphorus and potassium in the immediate buildup program. Straight materials could also have been used in the gradual buildup program, but it seemed practical to use only mixed fertilizers under this program even though higher fertilizer costs resulted.

The two fertility programs in which crops were fertilized on a year-to-year basis without a correction of the basic soil deficiency had the same fertility costs for each year of the ten-year period; however, the costs of the fertilizer program for moderate yields were substantially lower (less than half) than the cost of the fertilizer program for high yields.

There was little difference in the costs of the fertilizer programs among the three crop rotations.[7]

Rates of return on fertility program costs. The rates of return were computed by calculating the ratio of the value of the added crop production to the added cost of the fertility program (Table 3). The rates of return were highest for the fertility program in which crops were fertilized for moderate yields; however, this was the least profitable fertility program on a per-acre basis. Among the three fertility programs in which high yields are attained, the program in which crops were fertilized annually gave the highest return for the added costs in all years for all rotations. The rate of return from fertilizer costs under the immediate buildup program was lowest in the first year because of the

[7] The costs and returns from this study should not be used as a basis for choice among the rotations. Rotation choice must take into consideration all costs and returns, whereas this study shows only the added costs and returns associated with the fertility program.

Table 3. — Rates of Return on Costs of Fertility Programs, Excellent Illinois Soils[a]

Year	Fertility program			
	Immediate build-up	Gradual build-up	Fertilize crops for high yields	Fertilize crops for moderate yields
Corn-Soybeans				
1st year	1.3	2.0	3.5	3.9
2nd–4th year	3.0	2.0	3.5	3.9
5th–10th year	3.0	3.0	3.5	3.9
10–year average	2.6	2.5	3.5	3.9
Corn-Corn-Soybeans-Small grain (legume)				
1st year	1.3	2.1	3.6	4.5
2nd–4th year	3.2	2.1	3.6	4.5
5th–10th year	3.2	3.2	3.6	4.5
10–year average	2.8	2.7	3.6	4.5
Corn-Corn-Oats-Legume				
1st year	1.3	2.0	3.3	4.5
2nd–4th year	3.0	2.0	3.3	4.5
5th–10th year	3.0	3.0	3.3	4.5
10–year average	2.6	2.5	3.3	4.5

[a] Ratio of value of increased production to added fertilizer and other costs.

Table 4. — Estimated Yields Without and With Fertilizer, Good Illinois Soils[a]

Crop	Potential yield[b]	Depleted soils, percent of potential yield[c]	Depleted soils, yield	Yield increase with fertilizer for potential yields[d]
Corn	78 bu.	60	47 bu.	31 bu.
Soybeans	30 bu.	68	20 bu.	10 bu.
Oats	56 bu.	73	41 bu.	15 bu.
Wheat	34 bu.	52	18 bu.	16 bu.
Hay	2.6 tons	46	1.2 tons	1.4 tons

[a] Average for Fayette silt loam and Birkbeck silt loam.

[b] From Agronomy Fact Sheet SP-19, University of Illinois, Department of Agronomy. "Potential yields" represent expected 10-year average yields using the best technological methods, excluding irrigation.

[c] Computed from "percentage sufficiency" tables of R. H. Bray, University of Illinois, Department of Agronomy Mimeo AG 1198.

[d] Yield increases for moderate yields were estimated as follows: corn, 16 bu.; soybeans, 4 bu.; oats, 5 bu.; wheat, 10 bu.; and hay, 9 tons.

high cost of fertility buildup. The rate of return for gradual buildup was lower than that for immediate buildup during the second to fourth year because the costs of gradual buildup were spread over four years instead of being incurred in the first year only.

Among the three rotations there was little difference in the rate of return for any of the fertility programs. This suggests that the selection of a rotation is not a critical factor in the economics of choice of a fertility program.

Added Returns and Costs — Good Soils

Returns and costs. The potential yields of crops on good soils and the yields on these soils with depleted fertility levels are shown in Table 4. It is assumed that the same amounts of minerals are required to meet the requirements for potential yields on the good soils as on the excellent soils. The added values of crop production for the three fertility programs which attained potential yields were as follows for the three rotations: C-Sb, $26.55; C-C-Sb-Sg (leg), $26.13; C-C-O-L, $24.71 (Table 5). The added crop values for the fertilizer program in which crops were fertilized to attain the "moderate" yield level are as follows: $12.66 for the C-Sb rotation; $13.11 for C-C-Sb-Sg(leg); and $13.09 for the C-C-O-L rotation.

The same general relationships among fertilizer programs, rotations, and fertilizer costs were found in the analysis for the good soils as for the excellent soils. Fertilizer costs were lower for the good soils than for the excellent soils because the costs of fertility maintenance were lower. The costs for such things as seed and harvesting were also lower because of the smaller increase in yields from the depleted fertility level.

Rates of return. Rates of return on the costs of the fertility program were lower for the good soils than for the

Table 5. — Added Annual Crop Value and Fertilizer Costs per Rotation Acre by Years for Four Fertility Programs, Good Illinois Soils[a]

	Fertility program			
	Immediate build-up	Gradual build-up	Fertilize crops for high yields	Fertilize crops for moderate yields
Corn-Soybeans				
Added crop value	$26.55	$26.55	$26.55	$12.66
Fertilizer costs[b]				
1st year	$25.28	$14.22	$ 8.15	$ 3.36
2nd–4th years	8.70	14.22	8.15	3.36
5th–10th years	8.70	8.70	8.15	3.36
10–year average	10.36	10.91	8.15	3.36
Corn-Corn-Soybeans-Small grain (legume)				
Added crop value	$26.13	$26.13	$26.13	$13.11
Fertilizer costs				
1st year	$24.94	$13.40	$ 7.82	$ 2.90
2nd–4th years	7.89	13.40	7.82	2.90
5th–10th years	7.89	7.89	7.82	2.90
10–year average	9.60	10.09	7.82	2.90
Corn-Corn-Oats-Legume				
Added crop value	$24.71	$24.71	$24.71	$13.09
Fertilizer costs				
1st year	$25.24	$14.28	$ 8.59	$ 3.30
2nd–4th years	8.77	14.28	8.59	3.30
5th–10th years	8.77	8.77	8.59	3.30
10–year average	10.42	10.97	8.59	3.30

[a] Average for Fayette silt loam and Birkbeck silt loam.
[b] Includes added variable costs in addition to fertilizer.

Table 6. — Rates of Return on Costs of Fertility Programs, Good Illinois Soils[a]

Year	Fertility program			
	Immediate build-up	Gradual build-up	Fertilize crops for high yields	Fertilize crops for moderate yields
Corn-Soybeans				
1st year	1.1	1.9	3.3	3.8
2nd–4th year	3.1	1.9	3.3	3.8
5th–10th year	3.1	3.1	3.3	3.8
10–year average	2.9	2.6	3.3	3.8
Corn-Corn-Soybeans-Small grain (legume)				
1st year	1.1	2.0	3.3	4.5
2nd–4th year	3.3	2.0	3.3	4.5
5th–10th year	3.3	3.3	3.3	4.5
10–year average	3.1	2.8	3.3	4.5
Corn-Corn-Oats-Legume				
1st year	1.0	1.7	2.9	4.0
2nd–4th year	2.8	1.7	2.9	4.0
5th–10th year	2.8	2.8	2.9	4.0
10–year average	2.6	2.4	2.9	4.0

[a] Ratio of value of increased production to added fertilizer and other costs.

excellent soils, but the relationships among the fertilizer programs, rotations, and years of the ten-year period were similar to those for the excellent soils (Table 6). Fertilization of crops for high yields returned the highest average net return over the ten-year period of the three fertility programs providing for high yields. The immediate buildup program provided the second highest rate of return for the ten-year period. As was the case with the excellent soils, the rate of return was lowest during the first year for the immediate buildup program. Fertilization for moderate yields gave the highest return per dollar spent for fertilizer and associated costs, but this fertilizer program did not give a crop yield level resulting in a high net return per acre.

There was little difference in the rate of return among the three crop rotations for the four fertility programs.

Returns for the Ten-Year Period

The costs and returns reported in this study thus far have not included interest on the added costs associated with each fertility program as a cost of production. Interest costs should not be disregarded

in such a comparison of programs in which there are substantial cost differences in any one year and differences in the timing of the costs over a period of years. To reduce the added net returns from each fertility program to a comparable basis, the stream of added net returns was discounted to a present value. This was done by discounting each year's income to the beginning of the ten-year period by using a 6 percent annual interest rate.

The ten-year added returns and the discounted returns for each fertility program and rotation are shown in Table 7. The general effect of the discounting procedure was to reduce the added net returns for the ten-year period by approximately 25 to 30 percent. The discounted returns for the two fertility buildup programs were 28 or 29 percent less than the ten-year added returns before discounting for all rotations. The discounted returns for the two fertility programs in which crops were fertilized for either high or moderate yields were 26 percent below the added returns without considering interest.

While the discounted returns were about 25 to 30 percent lower than the actual net returns for the ten-year period for all rotations, the discounting procedure did not substantially change the relative returns among the different fertility programs. The added returns were highest for the fertility program in which crops were fertilized for high yields. The returns for the buildup programs were 10 to 17 percent less than the discounted added net income in the fertility program in which crops were fertilized for high yields. Fertilizing crops for moderate yields resulted in returns 42 to 50 percent below the returns when crops were fertilized for high yields.

Summary

The costs and returns associated with four alternative fertility programs for two groups of Illinois soils were com-

Table 7. — Ten-Year Added Net Returns and Discounted Added Net Returns From Four Fertility Programs, Excellent and Good Illinois Soils

Rotation and fertility program	Excellent soils		Good soils	
	10–year added net returns	Discounted 10–year added net returns[a]	10–year added net returns	Discounted 10–year added net returns[a]
Corn-Soybeans				
Immediate buildup	$213.71	$154.08	$161.92	$115.72
Gradual buildup	207.02	149.47	156.42	112.23
Fertilize crops—high yields	246.50	181.40	184.00	135.41
Fertilize crops—moderate yields	125.70	92.50	92.40	68.00
Corn-Corn-Soybeans-Small grain (legume)				
Immediate buildup	$224.91	$162.20	$165.35	$118.15
Gradual buildup	218.82	158.15	160.36	115.14
Fertilize crops—high yields	252.20	185.59	183.10	134.75
Fertilize crops—moderate yields	132.50	97.51	102.10	75.14
Corn-Corn-Oats-Legume				
Immediate buildup	$214.65	$154.76	$141.13	$101.77
Gradual buildup	207.98	150.17	137.36	98.21
Fertilize crops—high yields	242.10	178.16	161.20	118.63
Fertilize crops—moderate yields	145.00	106.71	97.90	72.04

[a] The added net returns for each of the ten years are discounted to present value at the interest rate of 6 percent.

pared in this study. Comparisons were made for three rotations over a ten-year period.

Fertility programs providing for a buildup of phosphorus and potassium to correct the deficiencies shown by soil tests had higher costs than the fertility program in which crops were fertilized annually for high yields. The buildup costs were particularly high in the early years of the ten-year period. An annual crop fertilization program designed to increase crop yields about one-half of the potential increase was a low-cost fertilizer program but was substantially below the most profitable level on a per-acre basis.

The annual crop fertilization program resulted in a high ratio of returns to costs in comparison with the fertility buildup programs in all years of the ten-year period and for all rotations. The rates of return were higher for the excellent soils than for the good soils, but the general relationship among fertility programs was the same for both groups of soils.

There were small differences in costs of fertility programs and rates of return on fertility program costs for the three rotations; however, the selection of a rotation was not a critical factor affecting the economics of choice of a fertility program.

Discounting the ten-year stream of added net returns from each fertility program to a present value reduced the added net returns by 25 to 30 percent but did not result in any substantial change in the relative returns among the different fertility programs.

Some International Comparisons of Food Consumption

RICHARD D. MILLICAN

ENGEL'S LAW (AS INCOME INcreases, the percentage spent for food decreases) has been repeatedly tested by empirical research, but little has been done to compare the kinds of food consumed at various income levels. Although the percentage spent for food decreases with rising income, the monetary amount increases. This indicates that the kinds and amounts of food purchased are subject to change as incomes change. It has also been observed that this pattern of change may vary among countries.

This article reports research based on data from the state of Illinois, Dominion of Canada, United Kingdom, and Union of South Africa.[1] The purpose of the study was to examine the character of food consumption expenditures in each of these areas at three equivalent income levels. The income levels were selected so that the total weekly food consumption expenditure at each level was approximately the same in each area. Although it is difficult to select these equivalents because classifications in various countries are not always the same, some data were found that could be compared.

Nature of the Data Used

Sources of data used for the comparisons were as follows:

Illinois. In the spring of 1961, data on total expenditures were collected from 1,144 Illinois families in which the wife was a member of a unit in the home-adviser program of the Cooperative Extension Service. Units were randomly

[1] In this country, now called the Republic of South Africa, the currency unit is the rand, equivalent in dollar exchange to $1.40. When this study was made it was still the pound at $2.80, the same as the British pound.

Table 1. — International Comparisons of Weekly Food Consumption per Family at Three Income Levels

Food class	High income			Middle income			Low income			
	Illinois ($6,000-7,499),[a] 1960	Canada ($6,000-7,000), 1957	United Kingdom ($7,280 and over), 1957-1959	Illinois ($4,500-5,999)[a]	Canada ($5,000-5,999)	United Kingdom ($4,368-7,280)	Illinois (under $3,000)[a]	Canada ($2,500-2,999)	United Kingdom ($2,912-4,368)	Union of South Africa ($3,946) 1955
Dairy products	$ 3.14	$ 3.61	$ 4.65	$ 2.78	$3.48	$ 4.00	$ 1.64	$ 2.94	$ 3.42	$ 3.35
Meat, fish and poultry	5.21	7.08	6.47	4.85	6.65	5.46	2.77	5.55	4.56	5.15
Fruits and vegetables	3.26	3.88	3.44	3.02	3.74	3.05	2.11	3.52	2.63	3.40
Staples	4.98	6.66	6.38	4.64	6.72	6.03	2.98	5.45	6.15	5.23
Meals bought	4.93	4.39	5.80	2.41	3.70	2.80	1.31	1.49	1.99	1.23
Home-produced food	3.62	[b]	[b]	4.11	[b]	[b]	3.86	[b]	[b]	[b]
Total	$25.84	$25.62	$26.74	$21.71	$24.29	$21.34	$15.67	$18.95	$18.75	$19.36

[a] Adjusted to 1957 price level.
[b] Amounts not available.
Sources: Richard D. Millican, *A Consumption Expenditure Study of Illinois Families*, Illini Union Bookstore, Urbana, 1961. *Urban Family Food Expenditure, 1957*, Dominion Bureau of Statistics, Prices Division, Ottawa. *Family Expenditure Survey, 1957-1959*, Ministry of Labour, Her Majesty's Stationery Office, London, 1961. *Survey of Family Expenditure, November, 1955*, Bureau of Census and Statistics, Pretoria, Union of South Africa.

selected from the 2,000 extant, and all members of each selected unit (about 25 on the average) were asked to supply the information. Almost every county in the state was represented, and the division of the questionnaires used, by place of residence, was 648 rural, 232 rural nonfarm, and 264 urban. These designations were not made by census classifications, but by the selection each family checked in the budget schedule. Data were collected for weekly food consumption by categories as shown in Table 1.

Dominion of Canada. These data were collected in nine major cities in the Dominion in 1957. A semi-panel technique was used in which repeated checks were made with certain families to get continuity of expenditure. Data from 1,757 urban families were used.

United Kingdom. These data were collected by the Ministry of Labour during 1957-1959. About 5,000 addresses were selected and the occupants interviewed in waves. The occupants were asked to keep detailed records for 14-day periods, and to supply other information over longer periods. Total sample size was 2,836.

Union of South Africa. These data were collected by the Bureau of Census and Statistics in 1955. Data were collected from white families only in 15 urban areas in the Union. Families were selected at random, and 2,325 families were used.

It can be seen that the characteristics of the parent populations and samples vary with each country, but that random selection was used when the sample was drawn. There is evidence that the response in relation to the total sample drawn was never over two-thirds, and in some instances even lower.

In one test made by the British government the size of the reporting error varied inversely with the frequency of the expenditure. This variation would be expected since memory of expenditures made at frequent intervals is more accurate than when long intervals occur between expenditures, as in buying furniture, for example. In this paper, which is concerned with food expenditures on a weekly basis, the response error therefore is likely to be low compared with others.

The differences among countries in the time periods in which the studies were conducted should be mentioned. Since expenditure patterns change rather slowly, these differences are not believed to be serious. Further, the Illinois data were adjusted to the 1957 price level.

Nature of the Methodology

The data used were averages per family, calculated from the weekly sums of expenditures for each food class and for the total expenditure. Given these data, the chi-square test appeared to be the most suitable method of analysis. This test was used at the 5-percent level to determine the significance of differences.[2] The IBM 1401 was used for all calculations. The frequencies representing "actual" in the formula were those from the Illinois study, and the expected frequencies were those from the other three countries.[3] After these calculations were made, a Fisher table[4] was used to determine whether the differences in expenditures in each class were significant. Table 1 shows the weekly expenditures.

Analysis of the Data

To interpret the similarities and differences that prevail at the various income levels, each income level is discussed separately, then the three analyses are drawn into a general conclusion. The income levels are referred to as high, middle, and low. This does not mean that the three levels actually represent these positions in the income distribution of the various countries. Rather, the families are matched in terms of weekly expenditures for food. Illinois prices were adjusted on the basis of the Consumer Price Index prevailing for the various food categories in 1957. The Canadian prices remained the same since the data were collected in 1957, and the Canadian dollar in exchange did not differ greatly from the United States dollar. The British and Union of South Africa conversions were made on the basis of the pegged price for the British pound at $2.80.

An analysis of the three income categories follows. The available data do not show statistically significant differences in the expenditure pattern between Illinois and the three countries of comparison. However, it should be recognized that many factors other than income play a role in determining the food expenditure pattern. For example, both the relative prices of the various food classes, and the price of food in relation to other consumer items will vary from country to country. Family size may also be expected to vary. Consequently, the differences noted below are only suggestive of the international differences in expenditure patterns that exist after only the differences due to income have been taken into account.

High income. As intended by the selection of data, the total weekly food consumption in dollars was about the same for the three areas. Average expenditures for each food class are presented, with the exception of *home-produced food* for Canadian and British families. This item was estimated by the rural segment of the Illinois sample but there was no equivalent available for Canadian and British families.

A marked difference in expenditure for certain items appeared among the three countries (see Table 1). *Meats and staples* accounted for the greatest difference in consumption patterns between the Canadian and Illinois families, and *dairy products* and *staples* differed most in the

[2] The formula for computing chi squares is as follows: $\chi^2 = \frac{(E-A)^2}{A}$ where E is the expected frequency, and A the actual frequency.

[3] In the Union of South Africa, data were available only for the low-income classification, and this classification represented a mean for all the cities covered in the survey of South Africa.

[4] George W. Snedecor, *Statistical Methods,* Collegiate Press, Inc., Ames, Iowa, 1938, p. 163.

comparison of British and Illinois families.

The differences were more marked between British and Illinois families than between the Canadian and Illinois, which may be explained by climatic and dietary variations, and also by the higher income level of the British families used.

A marked difference in expenditure for the *meals bought* category was noted between the British and Illinois families. One of the signs of a high-income level is a higher allocation for this item. Actually it is a mixed expenditure, partly for food and partly for recreation or entertainment.

Middle income. In this income classification the Canadian families spent a little more for food than did the Illinois and British families. Differences in *staples* and *meals bought* were more pronounced than for other food groups in the comparison of Illinois and Canadian families. Much of the difference in total dollar expenditure was explained by these two items. The amount for *home-produced food* was important for the Illinois families.

The differences between Illinois and British families that occurred at high-income levels persisted in expenditures for *dairy products* and *staples*. This presents the possibility that price differences for those commodities would affect choices at this income level. It was noticed also that the expenditure pattern for the British families was more similar to the Illinois than to the Canadian.

Low income. Since the Union of South Africa was included in this category, four sets of families were compared. The average weekly food expenditure for food declined from the middle-income group, and in the Illinois families was much lower than the others. This difference may be partly explained by the nature of the Illinois sample, which contained a large number of single, retired persons.

In comparing Illinois with Canadian families, all items showed greater differences at this income level than at the other income levels. This was especially true of *dairy products* and *meats*. The *meals bought* category differed little, which would be expected at the low-income level. Part of the difference in the other items may be explained by the relatively large difference in total food expenditure, which in turn would affect the individual outlays.

The difference in total food expenditure and its effect were also noted when the Illinois and British families were compared. Amounts spent for *dairy products* and *staples* were quite different, varying more than in the high- and middle-income groups but not significantly so. Dietary and price differences as well as income, would be determinants in expenditure. A marked difference in the *meals bought* category was again noted which could be explained in terms of sample differences.

The Illinois and Union of South Africa families showed about the same differences as were noted between Illinois and Canadian families. Differences in expenditures for *meats* and *staples* were the most prominent, whereas the *meals bought* category was hardly different. There was a striking similarity between the Canadian and Union of South Africa families, influenced no doubt by the fact that both samples were composed of white and urban families.

Summary and Conclusions

Food expenditures of a sample of Illinois families at three income levels were compared with those of similar samples in Canada, the United Kingdom, and the Union of South Africa. (Suitable data

for high- and middle-income levels in the Union of South Africa were not available.) Expenditures for various food classes were compared in each of the three income levels. Chi-square tests were used to determine the significance of differences.

The differences in the food expenditure pattern between Illinois and each of the other areas were not significant. One might expect a fair degree of similarity in food consumption patterns among English-speaking peoples in approximately the same income level. However, some interesting contrasts did appear in the data.

Among the high-income families *meats* and *staples* accounted for most of the difference between the Illinois and Canadian families, but *dairy products* and *staples* differed most between Illinois and British families. The Canadian families in this income class were more nearly like the Illinois families than the British. The British families used were at the highest income level in their own sample distribution, while those of the Illinois and Canadian samples were a little lower than the highest income families in their countries. Despite this difference, variations in expenditures might also be expected in view of climatic, dietary, and cultural differences that might assert themselves. Prices of items and availability when the data were collected would need to be considered in a more complete analysis.

In the middle-income group, expenditures for *dairy products* were the most important difference between the Illinois and British families; between Illinois and the Canadian it was *staples*. The amounts spent for *meals bought* declined from the high-income class for all three groups. This item is especially sensitive to an income decline.

In the low-income group the Union of South Africa families were added to the analysis. *Dairy products* and *meats* differed most between Illinois and Canadian families, which may be partly explained by sample differences. *Dairy products* and *staples* differed most between British and Illinois families. The Union of South Africa families showed differences between *meats* and *staples* as compared with Illinois. The South African families were similar to the Canadian families partly because urban white families predominated in the samples. Again, the *meals bought* category declined from the middle-income level in all groups.

Considering the ethnic tie plus the narrow variation in climate (primarily temperate), we would expect that allocations for total weekly food consumption at the various income levels would be similar. But even with this uniformity, differences in cultural background, economic conditions, and food prices constitute variations that cause differences in food consumption.

Illinois Farmers and Their Property Taxes

R. G. F. SPITZE

FEW PROBLEMS FACING ILLINOIS are as crucial as its fiscal crisis. In the process of solving this crisis, changes will doubtless be made both in tax levies and in public services, and these changes are certain to have important consequences for all citizens. In an earlier issue of *Illinois Agricultural Economics,* the tax trends of the state were compared with those of other states and the most common proposals for tax reform were discussed.[1] The purpose of this paper is to offer an analysis and critique of the existing property tax situation as it pertains to Illinois agriculture.

Nature of the Property Tax

Farmers in Illinois pay practically every tax levied on any citizen of the state, but the nature and magnitude of the property tax make it one of the most, if not the most, burdensome. The other major tax revenue source in Illinois is the retailers' occupation and use tax (sales tax). Since this tax is regressive with respect to income, and since farmers' income is generally below the average for the state, it too exerts a particular burden on farmers. The federal income tax is, of course, also an important tax for Illinois farmers, but neither this nor the sales tax is within the scope of the present discussion.

At the outset two remarks about the nature of the property tax are relevant, namely, that the tax is almost exclusively a local levy, and that Illinois government relies heavily upon the property tax for its revenue. Both of these factors are intimately related to the nature of the tax burden borne by Illinois agriculture.

[1] "Illinois Tax Trends," by N. G. P. Krausz, *Illinois Agricultural Economics* 1(1): 10-15, 1961.

Property tax a local levy. Property tax assessment is largely a local function, usually at the township level (more fortunate counties have the help of a county supervisor), and the uniformity and administration expected of federal and state governments cannot be counted on. The adequacy and equity of the assessing function are greatly dependent upon the local financial resources available for support, the quality of local complementary government services, and the ability of the local personnel upon whom responsibilities for assessment rest. Increasing amounts of state aid based upon the adequacy of the local tax base make for more uniformity and equity in tax matters, but with the exception of these state aid measures, the moderate amount of supervision of assessments provided by the state department of revenue, and rate limits provided in state statutes, each local unit of government is essentially its own policy maker in property tax matters.

Now local administration means reliance on well-intentioned but hurried and at times unskilled personnel for assessments. This situation, combined with unworkable state statutes, discourages thorough assessments on intangible, inaccessible, and unfamiliar property.[2] And, contrasted to farm property both personal and real, most nonfarm property is in fact comparatively intangible, inaccessible, or unfamiliar to tax assessors. Much farm property is visible and similar from owner to owner, e.g., tractors, livestock, or feed inventory, and value is

[2] H. K. Allen contends that though half of the total wealth of Illinois consists of personal property, it accounts for only 20 percent of the total property assessments. "The General Property Tax," Chapter 3 in Part II of *Report of the Revenue Laws Commission,* State of Illinois, 1949, p. 30.

often discernible on commodity market pages or in deed records' books. The farmstead, in other words, is somewhat more familiar and tangible, and thus more readily placed on the tax rolls than the complexities of the supermarket or the manufacturing concern.

Property tax an important source of revenue. Also relevant to the property tax burden on Illinois agriculture is the heavy reliance which government within the state places on this tax for its revenue needs.[3] Among the public services that have mushroomed the fastest in recent years is one that has traditionally been provided at the local government level. This is primary and secondary education, and the property tax has had to bear an increasing burden for its support. Other services emerging with the more urban character of many industrial communities, such as sanitation, utilities, welfare, and police and fire protection, fall heavily upon the property taxpayer. The dependence of Illinois local government upon the property tax is generally comparable to that found at the local level across the United States, but when the comparison is made for all government within the state, the Illinois property tax assumes a bigger role. This dependence has increased slightly since 1953. The proportions of tax revenues derived from the property tax in 1960 were:

	Local government	Local and state government
	(percent)	
Illinois	88.1	52.7
United States	87.4	45.4

Source: U. S. Department of Commerce, *Government Finances in 1960.*

Economic Basis of the Property Tax on Farm Property

Years ago, to tax property was to tax farm property. The economy was largely agricultural; the farm was the place where the wealth existed and the income originated. "The property tax was designed mainly for a rural civilization and still retains its rural cast."[4] Today with the major portion of the nation's population, employment, capital, and income associated with the off-farm sectors of the economy, the historic prominence of property as the tax base merits review. In 1960 Illinois farm population accounted for 5.6 percent of the people, farm income only 2.4 percent of the total income, but farm property still provided 13.3 percent of the property taxes. It is evident from the following table that the relative burden has persisted, if not worsened, since 1953.[5]

	1953	1960
	(percent)	
Farm property taxes as proportion of total property taxes	15.3	13.3
Personal net farm income as proportion of total personal income	4.1	2.4
Farm population as proportion of total population	7.8	5.6

Farm land still represents a marketable asset for an owner but has lost its position as a primary indicator of wealth. Most of the wealth, including production and consumption of the nonfarm economy, assumes a form other than land. Even for the farmer, 33 percent of his total assets are now nonreal estate assets, and if the buildings were included, the percentage would be substantially

[3] Due, John F., "The Illinois Tax Problem," *Illinois Business Review,* 16(5) 6-8, 1959.

[4] Groves, Harold H., *Financing Government,* New York, Henry Holt & Co., 1958, p. 55.

[5] The sources of these figures are: U.S. Department of Commerce, *Government Finances in 1960*; U.S. Department of Commerce, *State and Local Finances in 1942 and 1947*; USDA, *Supplement to the Farm Income Situation for July 1962;* U.S. Department of Commerce, *Survey of Current Business,* August 1961; U.S. Department of Commerce, *Personal Income by States Since 1929*; U.S. Department of Commerce, *U.S. Census of Population,* 1960, PC (I)-15C. The figure for the farm population as proportion of total population is estimated for 1953.

greater.[6] If the property tax is designed to tax wealth, it seems sensible that the vast array of wealth now supplementing the land resource both on and off the farm should be tapped. Most farm property is a productive factor input, yet its use does not insure a certain income.

On the average for the United States, the estimated rate of return on farm real estate declined from about 8 percent in the early 1950's to 3 percent in 1959, when the cost for all farm labor is imputed at the same rate as hired labor.[7] More specifically for Illinois, analysis of earnings for farmers with farms in the 180- to 259-acre group (those keeping records with the University of Illinois) shows an average annual capital and management return over the past ten years of $5,700 in northern Illinois. These farms were using at least $100,000 worth of capital.[8] Even though farm property represents a marketable asset, its income-producing power has apparently diminished in recent years.

Convincing evidence is also available that the per capita net income of people living off the farm increased during the 1950's relative to the income of the farm population, thus widening a gap that has persisted for many years. Yet this same farm population has the burden of educational and other costs of rearing children, especially when one considers the large number of farm youth migrating to urban areas for their productive years. Thus, while farm income is lower relative to nonfarm income, and public services are demanded and used more and more by the urban population, the farm population still assumes a heavy part of the burden of the property tax.

But some economists may ask whether an alleviation of the property tax burden will bring any ultimate relief to the farmer's financial situation. Are not the changes in farm land taxes counterbalanced by related adjustments in land values? The theory supporting this contention is that the current value of any productive asset is determined by the sum of all future income anticipated from that factor of production, with appropriate discounts for the time lapse. Thus, the reasoning goes, if land taxes are lowered with income thereby raised, land values and hence costs will rise enough to offset the benefits over the years; the opposite would be true with increased land taxes.

However, research suggests that taxes do affect land values in this way, but apparently not proportionately. It would be difficult to justify by this theory alone the level of farm land values in recent years when compared to the computed low annual rate of return to land. This is particularly so in view of the fact that land values continued an upward trend during the fifties at the same time that computed returns to farm land declined. Similarly, there has been a continued use of farm labor in agricultural production with relatively lower labor returns than nonfarm workers are receiving. Thus, as long as both labor and capital resources are allocated as they are in farming, often irrespective of low earnings, a lowered land tax burden would be expected to result in some real enhancement of income, and hence of level of living, to farm operators and owners, instead of being entirely negated by land value adjustments.

---

[6] *Balance Sheet of Agriculture 1962,* USDA, p. 2.

[7] *Current Developments in the Farm Real Estate Market,* USDA, February, 1960, p. 24.

[8] *1961 Summary of Illinois Farm Business Records,* Ill. Ext. Ser. Cir. 853, p. 3-5.

Comparative Burden of the Illinois Farm Property Tax

Taxes on farm land vary widely within and among states. In this section some comparisons are made that illustrate the differences in tax loads among economic sectors of Illinois and between Illinois and other states. The tax pattern for one state is not necessarily the desirable one for the other states, but trends of one state can assist in the appraisal of tax problems and alternatives for another state.

Within Illinois agriculture. First we shall look at the tax situation from the perspective of the individual farmer as businessman and income earner. The following table shows the average real estate taxes that were levied on each owner of a farm (1960 average):[9]

Taxes per farm	$796.00
Taxes per acre	$ 4.07
Taxes per $100 value of real estate	$ 1.27
Taxes per $1,000 net farm income before property taxes	$150.21

In that year total net farm income, before real estate taxes were paid, was estimated on the average for all Illinois farms as $5,300 in returns to labor, management, and owned capital. Considering only farms of 180-259 acres which were keeping records with a management service sponsored by the University of Illinois,[10] total personal and real estate property taxes per farm ranged in 1959 from an average of $850 in southern Illinois to an average of $1,473 in northern Illinois. Net income on these farms of course was higher than the average of all farms.

The tax burden can also be viewed from another perspective, namely the extent to which any particular rate of levy varies with the income out of which all taxes must be paid. This is one of the crucial considerations with the farm property tax since taxes are usually provided from current income or the preceding year's income. While the level of absolute taxes tends to change little from year to year, farm income is much more variable. Thus, in one year the tax burden relative to income can be greatly amplified. The variability and upward trend of the Illinois farm property tax in relation to income for the period 1949-1960 are shown in Fig. 1.

Fig. 1. — Total farm personal and real estate taxes per $1,000 net farm income in Illinois.

Between agriculture and the rest of the economy of Illinois. Tax burdens not only exist in absolute terms for any taxpayer, but also in comparison to burdens other taxpayers are carrying. Due partly to the historical prominence of farm land as the primary tax base, to the reliance of Illinois rural government on the property tax, and to assessment prac-

[9] The source of this information was the U.S. Department of Commerce, Census of Agriculture, Illinois, 1959; USDA, *Farm Real Estate Taxes,* RET-1, June 1961. The limitations of available data prevent a separation of taxes on buildings from those on land, thus figures for farm real estate property taxes found in this table refer to land with improvements.

[10] Krausz, N. G. P., Mueller, A. G., and Gomein, R. B., *Property Taxes Paid by Illinois Farmers,* Ill. Agr. Exp. Sta. AERR-51, 1962, p. 6.

Table 1. — Proportion of Income Taken by Property Tax Shown for the Agricultural Sector and for the Total Economy of Illinois, 1949-1960

Year	Agricultural sector				Total economy			
	Total personal and real estate property taxes on farm property	Total net farm income to farm operators before property tax paid; excluding farm rent to nonfarm landlords	Proportion farm property tax is of net farm income[a]	Average farm property tax per capita of farm population[a]	Total (personal and real estate) property taxes[a]	Total personal income	Proportion property tax is of personal income[a]	Average property tax per capita of total population[a]
	(millions of dollars)		(percent)		(millions of dollars)		(percent)	
1949	74.3	712.2	10.4	...	.....	14,654	...	...
1950	80.5	829.3	9.7	$105	.....	15,984	...	...
1951	85.4	988.1	8.6	...	.....	17,777	...	...
1952	92.7	923.4	10.0	...	.....	18,579	...	...
1953	96.9	811.3	11.9	...	632.6	19,669	3.2	$ 71
1954	101.8	870.8	11.7	...	.....	19,751	...	...
1955	108.7	723.6	15.0	...	.....	20,968	...	...
1956	114.3	866.4	13.2	...	.....	22,857	...	...
1957	125.6	853.2	14.7	...	895.7	23,941	3.7	...
1958	134.6	875.0	15.4	...	915.7	24,100	3.8	...
1959	139.7	699.1	20.0	...	899.5	25,643	3.5	...
1960	145.7	712.4	20.5	259	1,098.3	26,425	4.2	$109

Sources: USDA, *A Supplement to the Farm Income Situation for July 1962;* U.S. Department of Commerce, *State and Local Government Finances in 1942 and 1957, 1958, 1959, 1960;* U.S. Department of Commerce, *Personal Income by States Since 1929;* U.S. Department of Commerce, *Survey of Current Business,* August, 1961.

[a] Data not available for some years. In computing percent of income going for property taxes, off-farm income of farmers is not included. On the other hand, the amount of the total property taxes paid by corporations before personal income is allocated is not separated out.

tices, the share of the property tax borne by farmers in Illinois remains high relative to other groups.[11] In Table 1, comparisons are made of these relative shares for agriculture and the total economy, including agriculture. The proportion of total net farm income (before property taxes) that went for property taxes increased sharply from 10 percent in 1949 to 20 percent in 1960. During the same period property taxes took only 4 percent of the net income of the entire Illinois economy. Furthermore, the per capita property tax payment in 1960 was $259 for the farm population and only $109 per capita for the total Illinois population.

Another view of this comparison is provided in a recent report by G. W. Fisher.[12] When Illinois counties were grouped according to their agricultural characteristics, it was found that the percent of personal income going into the local general revenue was much higher (almost double) for predominantly agricultural counties than predominantly non-agricultural counties. The results of assessment-income comparisons between agricultural and industrial counties are especially dramatic in that the former group has an assessment-income ratio almost three times greater than the latter.

Between Illinois and surrounding states. Comparisons of real estate property taxes paid in Illinois and those paid in surrounding states appear in Table 2. In this table we note that the per acre farm real estate tax payment for Illinois is largely a reflection of the inherently productive and hence valuable land that prevails throughout much of

[11] Similar conditions exist or are developing in other states. For example, see Halcrow, H. G., *Impact of Property Taxation on Connecticut Agriculture,* Conn. Agr. Exp. Sta. Bul. 321, 1956; Heneberry, W. H., and Barlowe, Raleigh, *Property Tax Trends Affecting Michigan Farmers,* Mich. Agr. Exp. Sta. Bul. 421, 1959.

[12] Fisher, G. W., "Illinois Local Government Finance: Geographic Variations," *Illinois Government,* University of Illinois Institute of Government and Public Affairs, April, 1962.

Table 2. — Farm Real Estate Property Taxes for Selected States and for the United States, 1960[a]

State	Real estate taxes			
	Total[b] (millions of dollars)	Per acre[b]	Per $100 value[c]	Per $1,000 net farm income[c]
Illinois	123.1	$4.07	$1.27	$150.54
Indiana	45.9	2.39	.88	104.47
Iowa	103.6	3.05	1.17	113.13
Kentucky	14.5	.80	.57	43.53
Michigan	32.9	2.01	1.04	110.19
Missouri	32.8	.96	.85	61.42
Wisconsin	54.9	2.44	1.82	111.99
United States, excluding Alaska and Hawaii	1,284.0	1.20	.99	88.96

[a] Farm real estate taxes include levies on both land and improvements.
[b] USDA, *Farm Real Estate Taxes*, RET-1, June 1961.
[c] Computed by W. H. Heneberry, Economist, Economic Research Service, USDA. The figures on $1,000 net income indicate the average for 1959 and 1960. Net income refers to total net farm income (including rental value of farm dwelling and value of farm products used in the household) plus net rent to nonfarm landlords, before payment of farm real estate taxes.

the state. The total tax paid is, of course, a function of this per acre value times the size of the state's agricultural land base. Some states exhibit even higher total tax or per-acre tax payments, such as California with its vast area, and New Jersey with its cropland of high-value vegetable and fruit enterprises.

However, for a comparison of the relative burden on farm land owners and operators among states, the data of taxes per unit of value and income are much more meaningful. Illinois farmers pay a higher rate per hundred dollar value than farmers in any surrounding state except Wisconsin. When one views the

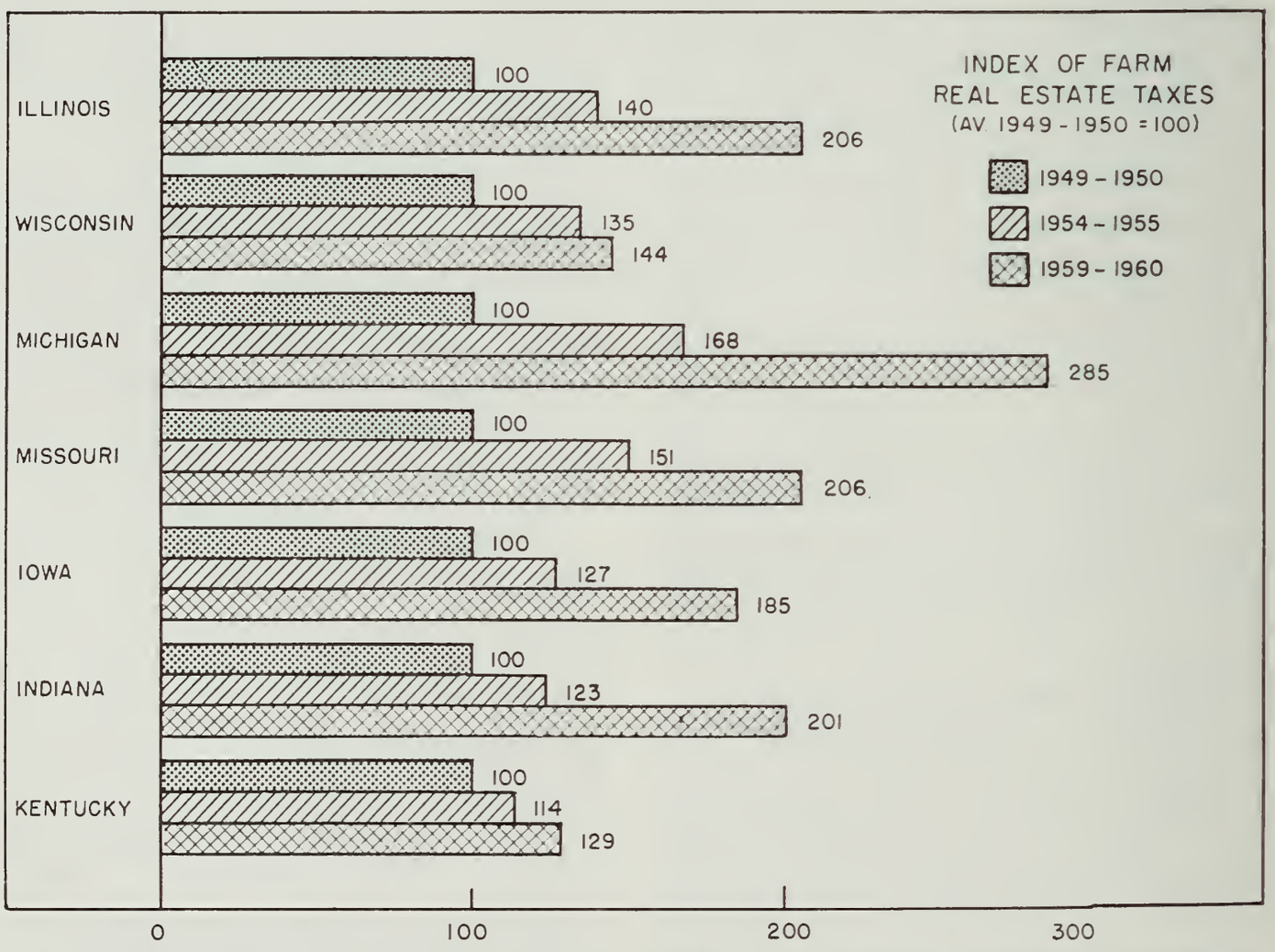


Fig. 2. — Trends in farm real estate taxes per $1,000 net farm income. (From a report "Burden of Property Taxes on Illinois Agriculture" by R. G. F. Spitze and W. H. Heneberry prepared for the Illinois Commission on Revenues.)

tax rate paid per $1,000 net income, Illinois farmers pay almost 50 percent more than producers in surrounding states and about twice the rate for the nation as a whole. Property taxes must be paid out of current income and thus compete with the needs of the farm family and interfere with the net capital investment of the farm business.

One final comparison is noteworthy: the trends in real estate taxes for these several states. In Fig. 2 these are presented for the last decade. Here again the real estate property tax burden as measured by taxes per unit of income, has been increasing faster for Illinois farmers than for those in all surrounding states, except Michigan, and even its current level is below that of Illinois.

Concluding Remarks

Illinois, along with its neighboring states, is facing a gradually worsening fiscal situation, involving both revenue and expenditure problems. Although some curtailment of expenditure is expected, the general consensus is that some additional revenue sources must be sought. And the evidence is that Illinois has the income potential to support increased public services without the tax burden being increased to a level prevalent generally in the nation. With the exception of two states, Illinois has a lower level of public expenditure per unit of income than any state in the union. Furthermore, the expenditures per capita are below the national average.[13]

However, due to the nature of the property tax in Illinois, the state's farmers (operators and landowners) are at present shouldering a heavier tax burden relative to the nonfarm population than the average farmer in other states. They also have a heavier tax burden relative to net farm income than farmers in all surrounding states. Over the last decade this relative burden has generally increased.

For these reasons new tax policies could be adopted to redistribute the tax burden more evenly among the state's population. Such policies, however, are likely to result in relative rather than absolute reductions. That is to say, the property owner could reasonably expect to find future state and local revenue needs being increasingly met by taxes other than the property tax, but outright reductions in property taxes do not seem likely.

---

[13] Fisher, G. W., "An Economist's Appraisal of the Illinois Tax System," *Law Forum,* University of Illinois, Winter, 1961, pp. 543-585.

Surface Water Control in Areas Adjacent to Municipalities

N. G. P. KRAUSZ

NUMEROUS LAWS HAVE PROvided for governmental units and agencies with power to control drainage and floods. Some of these laws exercise their authority primarily in urban areas, others in rural areas, but neglect is frequently apparent in the zone between the two — often called the fringe area. The following is a discussion of the various units and agencies concerned with surface water control, most particularly as their authority and jurisdiction are related to this fringe area.

Soil and Water Conservation Districts

One agency that has given some help in the fringe area is the *Soil and Water Conservation District.*[1] The policy of these districts, as declared in the law, is to conserve soil and water, prevent erosion and floodwater, control floods, assist in navigability of rivers, and promote the health, safety, and welfare of the people. The Illinois State Department of Agriculture is charged with the duty of assisting and informing soil and water conservation districts, coordinating their activities, and seeking assistance from the federal government.

But it is unfortunately true that the intent and emphasis are on the agricultural side and as a practical matter little assistance is given to the rural-urban fringe area. The district's actual authority is quite weak when dealing with the problems of hundreds and thousands of fresh homebuilders whose immediate concern is a mortgage and a new T.V. set; however, help to these areas is given if sought, and many well-trained supervisory personnel from the U.S. Soil Conservation Service can provide sound advice.

A little-used provision in the Soil and Water Conservation Districts Act relates to land-use regulations. The directors of a district have authority to formulate regulations governing the use of land within the district in the interest of conserving soil and water resources, and preventing erosion, floodwater, and sediment damages. Any such regulation proposed by the directors may not be adopted unless three-fourths of the landowners approve in a referendum.

A method of supervision and enforcement of the land-use regulations is set up in the act. The directors have the authority to enter the lands and determine whether the land-use regulations are being observed. Also, the directors may provide by ordinance that any landowner who sustains damages from a violation of the regulations by any other landowner may recover damages. Where the directors find that a particular landowner is violating the regulations, they may file a petition in the Circuit Court to compel compliance.

Federal Watershed and Flood Prevention Act

Another law with agricultural overtones but which is an extremely helpful instrument for urban and fringe areas is the *Federal Watershed and Flood Prevention Act.*[2] On July 31, 1953, the President sent a message to Congress stating that there was a need for con-

[1] C. 5, ss. 106-130. All references, unless otherwise specified, refer to chapter and section of the Illinois Revised Statutes, 1961 edition.

[2] U.S. Code, Title 16, ss. 1001-1008.

servation of land and water in our smaller stream and river watersheds, particularly in upstream areas. A quickly drafted bill gave the Secretary of Agriculture authority to cooperate with state and local agencies in planning and carrying out "improvements" for flood control and for soil and water conservation.

In 1954 Congress passed Public Law 566 to carry out the President's plan. Following are some of its important provisions:

1. Local organizations (such as a city, village, county, soil and water conservation district, drainage district, irrigation or reservoir company, water user's association, or similar organization having such authority and not operated for profit) may apply to the Secretary of Agriculture for assistance. The application must be approved by a state agency or by the Governor and the Secretary of Agriculture. Before the Secretary approves, he must determine that the benefits will exceed the costs.

2. Federal aid is received in the form of joint planning, surveying, and financing with the local sponsoring organization. It is expected that over half of the cost of each improvement (such as a dam) will be paid from local funds.

3. The local sponsoring organization is required to acquire land, easements, and rights-of-way and provide for operation and maintenance.

Illinois Subdistrict Law

To facilitate the adoption of this law in rural areas, it appeared necessary either to give soil conservation districts the power to tax or to form an entirely new agency with taxing power. A solution in 1955 was the passage of an *Illinois Subdistrict Law,*[3] allowing soil conservation districts (changed to soil and water conservation districts in 1961) to form subdistricts within watershed areas — with the power to levy a tax in the subdistrict. The maximum tax rate in Illinois is 12½ cents per $100 valuation.

This money may be spent for developing and executing plans and programs relating to any phase of flood prevention, flood control, or erosion control, and for preventing or reducing damage from erosion, flood waters, and sediment. Federal funds are available if the subdistrict dowry is large enough and if certain requirements are met, such as (1) furnishing the land and (2) obtaining agreements from a portion of the landowners to carry out a soil conservation program. To date, the subdistrict law has not been used.

Several amendments to the federal law now make this legislation more attractive to urban areas, particularly for purposes of water supply and flood control. Perhaps the best use of this federal act will be realized if it results in a variety of projects sponsored by different kinds of local agencies, each "tailored" to fit some specific local situation. Certainly the program will have meaning only as local groups of citizens come to appreciate it as a tool for solving important water problems in various communities.

Drainage Districts

These have an agricultural orientation but have been most useful to new subdivisions in maintaining a drainage channel. The primary purpose of the Drainage Code[4] is to provide landowners with a legal entity (a drainage district) that can be used to force unwilling owners into the district and to secure adequate drainage or flood protection for its lands.

Drainage districts are based on a system of assessments which permit districts to include only lands benefited by the organization of such a district. Thus a

[3] C. 5, ss. 1316-138.1.

[4] C. 42, ss. 3-1 to 5-31.

person's land may not be included in a drainage district against his will, and hence he cannot become liable for assessments, unless it can be shown that his property will be materially benefited by the inclusion. The mere fact that the ditches of a drainage district carry off water that originates on his land does not mean, in legal sense, that he is benefited by the drainage district. If it appears that the water would naturally have flowed off the land, or could legally have been made to flow off it by artificial ditches, then he has adequate drainage and cannot be taxed simply because that water, after it leaves his land, finds its way to the ditches of a drainage district.

Generally speaking, the commissioners of a drainage district have broad comprehensive powers in regard to constructing and maintaining drains and levees.

Surface Water Protection District

A unit more suitable to the rural-urban water control problem is the *Surface Water Protection District*.[5] These districts are established to provide protection from damage to lives and property caused by surface water, and the district has the power to build structures to effectuate such purposes. These structures may include sewers, drains, ditches, levees, etc. In addition, the board of trustees of the district may enact ordinances to provide protection from surface water damage. The maximum statutory tax rate is 0.125 percent. With referendum, it is 0.25 percent.

Fifty or more of the legal voters living within the limits of a proposed surface water district, or a majority thereof if less than one hundred, may petition the county court of the county which contains all or the largest portion of the proposed district, to bring the question before the legal voters of such proposed district, whether such proposed territory shall be organized as a surface water protection district.

The district may not cover an area larger than two counties. It is not necessary that the boundaries of the district conform with the boundaries of any pre-existing political unit. However, if the boundaries of the district are coterminous with the boundaries of a city, village, or town, or if the district includes a city, village, or town that is authorized to provide surface water protection, such city, etc., must stop exercising powers that conflict with those exercised by the district in regard to surface water protection within one year after organization of the district. In other words a municipality and a surface water protection district can never exercise concurrent jurisdiction in regard to surface water protection.

River Conservancy District

For cities and villages on or along rivers or branches, the *River Conservancy District* has considerable potential.[6] A district is granted broad comprehensive powers to regulate flood control, drainage, irrigation, conservation, preservation of water levels, sanitation, etc. In addition, the statutes list more specific powers, including the authority to construct dams, levees, and bridges. Any plans adopted by the district must be submitted for approval to the Department of Public Works and the Sanitary Water Board.

In order to raise revenue, the act provides that the district may levy a direct annual tax for principal and interest on bonds, a tax up to 0.083 percent for general purposes (0.166 percent with referendum), and special assessments. In no case shall any property be assessed more

[5] C. 42, ss. 448-471.

[6] C. 42, ss. 383-404.

than it will be benefited by the improvement for which it was assessed. One percent or more of the legal voters living within the limits of the proposed river conservancy district may petition the county judge of the county which contains all or the largest portion of the proposed district to order a hearing and referendum for the purpose of determining whether such district shall be organized as a river conservancy district.

We have two such districts in Illinois (see below), one for the sole purpose of protecting a village and its fringe.

Sanitary Districts

These districts have broad powers for both sewage and water control. Most acts deal with special situations in the Chicago area. The first of the two concerns sanitary districts containing **one or more municipalities.** The district may cover more than one county, and does not have to conform to any preexisting political boundaries.

The board of trustees of the district has the power to provide for sewage disposal and drainage, which includes the power to construct drains, sewers, laterals, pumps, and pumping stations. Any 100 voters living within the limits of the proposed sanitary district may petition the county judge for a hearing and election. The maximum tax rate is 0.083 percent. With referendum approval, it is 0.166 percent.

The second of the two types of sanitary districts, those **outside municipalities,** must be contained within one county and must be outside the limits of any municipality. The board of trustees of the district has the power to provide for sewage disposal and drainage facilities.

In order to raise revenue, the district may levy, for principal and interest on bonds, a direct annual tax up to 0.25 percent for general purposes (0.50 percent with referendum), as well as special assessments. In addition, the district may collect from producers of industrial waste fair additional construction, maintenance, and operating costs over and above those covered by normal taxes. Any 20 percent of the legal voters living within the limits of the proposed sanitary district may petition the county judge for a hearing and election.

Except where there are combined drains, the emphasis of these districts is on a sewage system and not on water control. However, jurisdiction and authority seem quite extensive.

Authority of Cities and Villages

Cities and villages appear to have limited powers to control water outside their boundaries, except through the medium of planning commissions and plat control. However, there are a few special powers. A municipality has the power to construct or acquire a sewage system either within or without its corporate limits. Any watercourse that flows through its boundaries may be rechanneled. Also, whenever a stream of water terminates within the boundaries of a municipality or is nonnavigable, or the United States has abandoned jurisdiction over it, a municipality may fill in such stream for street purposes.[8]

State Agencies

Certain state agencies have a considerable amount of authority in regard to water and flood control. The *Department of Public Works and Buildings,* Division of Waterways, has the authority to make examinations, to survey, and to plan for the construction of works for flood control, improvement of land drain-

[8] C. 24, s. 11.

age, and conservation of water flow, in rivers, waters, and watersheds.[9] To carry out these plans, the Department may enter into cooperative agreements with the United States government and with local governments in Illinois.

The Board of Economic Development, of which the Governor is chairman, acts for the state in matters concerning any project for the improvement of navigation and flood control; it deals with the federal government on matters pertaining to any of the rivers, waters or watersheds of Illinois.[10] There is authority to study, investigate and recommend legislation on water use, flood control, drainage, and other water-related matters. Jurisdiction is thus very broad indeed but authority is limited in the main to voluntary agreements, except as approval is withheld in the area of interference with the use of waterways.

Planning Commissions

Since most drainage and flood problems could have been prevented by proper planning during the development of an area, the role of *Planning Commissions* appears to be particularly important. Although these commissions have no coercive power to enforce their plans, they can greatly influence and guide the thinking of officials who do have the power to adopt plans.

There are three important laws creating municipal and regional commissions and the Northeastern Illinois Metropolitan Area Planning Commissions. These allow broad general powers to develop comprehensive plans.[11] Jurisdiction of municipal commissions extends for 1½ miles beyond the corporate line. The county commission may encompass from less than one to one or more counties. Six neighboring counties cooperate with the NIMAPC.

When a municipality or a county decides to take preventive steps in combating drainage and flood problems in the fringe area, certain legal tools are available to accomplish the task. *Plat control* is the more direct weapon in that a person who desires to develop a subdivision is not allowed to record a plat of his land unless there has been compliance with the applicable ordinances and official map.[12] The ordinance can require sufficient improvements for drainage and flood waters, such as curbs, gutters, storm sewers, etc. This includes contiguous territory which is not more than 1½ miles beyond the corporate limits of the municipality.

The county board is empowered to prescribe reasonable rules and regulations governing the "location, width, and course of streets, highways and storm or floodwater run-off channels and basins, and the provision of necessary public grounds for schools, parks, or playgrounds." These rules may include requirements with respect to street drainage, and street surfacing. If any plan does not conform to such rules and regulations, it cannot be recorded.

Zoning

Zoning plays an indirect but important role in dealing with drainage and flood control problems. Zoning can facilitate adequate water flow and drainage and can secure safety from floods by (1) regulations against residential invasion below the flood line, (2) setting aside adequate areas for parks, basins and other public improvements, (3) preventing overcrowding and runoffs, and (4) protecting against conflicting uses.

[9] C. 19, s. 126b; C. 127, s. 49.

[10] C. 127, ss. 200-1, 200-4.

[11] C. 24, ss. 11-12-4, 11-12-5; C. 34, ss. 3001-3007.

[12] C. 24, ss. 11-12-12, 11-15-1.

City zoning applies to territory inside city limits and may extend for 1½ miles outside the city if the county has not adopted a zoning ordinance.[13]

County zoning includes territory outside municipalities.[14] Additional authority provided by the 1959 General Assembly to establish set-back lines along channels and basins should help immeasurably to control excess waters, by checking construction in low areas, by allowing percolation in adequate open areas (such as parks and forests) rather than rapid runoff in urbanized areas, and by offering protection against conflicting uses.

In recent years, flood plain zoning has received the attention of planners and engineers and has actually been put into practice in a few areas. The highway superintendent of DuPage County reports some success with minimum elevation restrictions for buildings. Our focus now should be on the possibilities and implementation of the new channel set-back lines allowed in the 1959 legislation.

Comprehensive zoning and planning regulations might also help with water control by imposition of requirements on street grades, minimum elevations, lot grading, basements, roof downspouts, water storage areas, and run-off channels.

Covenants and Conditions

The developer of property has two basic tools which he himself may employ to control the future use of the land: *covenants* and *conditions*. But since covenants and conditions in plats and deeds may be inserted only by private parties, and since the doctrine of nuisance is a remedy which may be invoked only after damage has occurred, these devices are generally remedial on a small scale and therefore not the best solution to drainage and flood problems.

It is evident from this discussion that there is no dearth of laws to create governmental agencies which may exert an influence upon the drainage and flood control problems which are confronting Illinois property owners in the rural-urban area. But in spite of this it appears that laws and existing agencies can be put to much better use than they are at present.

[13] C. 24, s. 11-13-1.
[14] C. 34, s. 3151.

Western European Food Import Propensities and Elasticities[1]

S. C. SCHMIDT

THIS ARTICLE IS DESIGNED TO provide a quantitative dimension to the analyses of the major economic factors affecting the magnitude and geographical distribution pattern of Western European (OEEC countries) food imports reported in "The Impact of Western European Integration on U. S. Exports" in the two preceding issues of this journal. Primary emphasis will be placed on the formulation and statistical estimation of relations that describe the movement of Western European food imports from the United States and on their applicability to indicate the probable future course of these transactions. For purposes of comparison, the effects of factors that affect the magnitude and pattern of Western European food imports from alternative sources of supply will also be considered.

The accomplishment of these objectives has been pursued by the application of a simple analytical model, the single-equation regression method of estimation. No attempt has been made in this paper to review either the existing body of literature on the statistical measurement of import-demand relationships or to discuss the relevance and methodological implication of any given analytical technique.[2]

As a first approximation, foods are defined as the conglomeration of three commodity categories: foods, beverages and tobacco, and oils and fats (SITC Sections 0 + 1 + 4). Such a method of aggregation adds to the complexity of statistical analyses because fluctuations in the magnitude of imports obtained from any region will depend, to a considerable extent, on the composition of these imports.[3] There are as many import-expenditure relationships as the number of commodities that constitute the aggregates. In this analysis, the food import structure is studied first by considering the largest possible aggregate, then by breaking this into smaller parts or commodity categories.[4]

Composite Food Imports (SITC Sections 0 + 1 + 4) From the United States

Table 1 gives the results of three alternative sets of estimating relationships built around a combination of four explanatory variables. The striking observation gained from the results in general is that, apart from analytical biases aris-

[1] Import propensities, particularly those expressed in terms of national income, are conceptually related to the general marginal-propensity-to-consume notion and hence reflected by the values of regression coefficients.

[2] For a comprehensive survey of previous import-demand and export-supply studies as well as other contributions to the field of international trade analysis see Hang Sheng Cheng, "Statistical Estimates of Elasticities and Propensities in International Trade." *Staff Papers,* International Monetary Fund 7(1): 107-158 (1959). For a critical appraisal of the advantages and inadequacies associated with the use of specific methods of estimation see Cowles Commission Monographs No. 10 and 14 or Carl F. Christ, "Simultaneous Estimation; Any Verdict Yet?" Econometrica 28: 835-845 (1960).

[3] SITC Section 0 embraces 36 different groups of agricultural commodities while Sections 1 and 4 represent the aggregation of four and three groups, respectively. See UN, *Commodity Indexes for the Standard International Trade Classification.* Statistical Papers, Series M., No. 10 (New York, 1953).

[4] For a description of trends in the structure of OEEC countries' food imports from the United States see S. C. Schmidt, The Impact of Western European Integration on U. S. Exports: Part II, *Illinois Agricultural Economics,* Vol. 2, No. 2, July, 1962, Table 4 and pp. 8-10.

ing from prevailing intercorrelation between the explanatory variables, the degree of association is invariably more pronounced once the effect of prices, internal as well as external, is eliminated.[5] In this connection the question must be raised as to whether the estimated parameters of relationships based on constant-value data are entirely reliable. It may well be that part of the discrepancy reflects errors of specification from the choice of nonrepresentative deflators rather than the isolation of changes that would have taken place had prices remained unchanged. While no definitive answer to this question can be given here, the sharply downward-trending import deflator series probably had much to do with accentuating the importance of price elements on the pattern of food imports obtained from the United States.[6]

In the first analysis (equations 1a and 1b), food imports were expressed as a function of national income (X_2) and food import prices (X_{40}). The second analysis (equations 2a and 2b) used OEEC total exports to the United States (X_{51}) instead of national income as an indicator of how food import decisions are formed. The assumption underlying the introduction of the export variable was that without a concomitant improvement in the OEEC foreign-exchange position, and therefore in its capacity to import, the growth in national income cannot be readily translated into a growth of food imports.

The regression coefficients obtained from analyses based on current-value data as well as on the amount of variation in the dependent variable explained by both sets of independent variables were not significant. Likewise little confidence can be placed in the estimating capacity of equations 1b and 2b fitted by the use of constant-value data, although judging purely from the value of the coefficient of multiple correlation, the postulated relationships meet the statistical test of significance. However, because of the size of their standard errors, the individual regression coefficients are unsuitable for estimating purposes. One of the major reasons for the unsatisfactory results appears to be the high degree of intercorrelation among the explanatory variables.[7]

In an attempt to measure the influence of relative prices as well as to modify somewhat the effect of intercorrelated explanatory variables, equation 2 was reformulated by replacing food import prices (X_{40}) with the ratio of U. S. to Canadian wholesale prices of farm commodities, represented by the variable X_{62} (equation 3). Notwithstanding some improvement in the overall degree of association between the dependent and explanatory variables, this treatment yielded only one regression coefficient (X_{62} in equation 3b) that differed significantly from zero at the 5-percent level.[8] By contrast, the coefficient for X_{51} in equation 3b was not improved even though its simple correlation coefficient with the dependent variable was 0.75 and its simple correlation with the other independent variable X_{62} was −0.67. Since intercorrelation in this analysis

[5] High intercorrelation tends to alter the sign and generally lowers the reliability of individual regression coefficients. See K. A. Fox and J. F. Cooney, Effects of Intercorrelation Upon Multiple Correlation and Regression Measures, U. S. Agricultural Marketing Service, AMS-341, 1954.

[6] Since the average value indices of total imports and exports are made up of all imported and exported goods, it seemed reasonable to use them as deflators.

[7] Simple correlation coefficients of −0.83 were obtained in both equations 1a and 1b for the relationship of X_2, X_{40}; and coefficients of −0.88 and −0.75 in equations 2a and 2b for the relationship of X_{40}, X_{51}.

[8] Among the four explanatory variables considered in these analyses, X_{62} showed the highest degree of association (−0.83) with the dependent variable.

Table 1. — Composite Foods (SITC Sections 0 + 1 + 4): Factors That Affect Changes in OEEC Imports From the United States, 1951-1960

Equation number	Type of data[a]	Regression equations[b]	Coefficient of correlation	Standard error of estimate
1	a	$X_{50} = 3{,}416.55 - 1.13X_2 - 20.45X_{40}$ (2.96) (16.92)	0.54	181.68
	b	$X_{50} = 2{,}382.05 + 2.32X_2 - 17.67X_{40}$ (3.90) (14.87)	0.76	161.94
2	a	$X_{50} = 2{,}676.40 - 15.39X_{40} - 0.004X_{51}$ (19.54) (0.180)	0.52	183.54
	b	$X_{50} = 2{,}110.29 - 12.89X_{40} + 0.13X_{51}$ (15.81) (0.14)	0.78	157.32
3	a	$X_{50} = 5{,}819.43 + 0.01X_{51} - 47.70X_{62}$ (0.09) (27.84)	0.66	160.74
	b	$X_{50} = 5{,}776.59 + 0.11X_{51} - 49.88X_{62}$[c] (0.07) (21.28)	0.87	123.24

[a] Where: *a* refers to functions based on current value data and *b* to functions based on constant (1953) value data. All trade series, import or export, pertain to millions in U. S. dollars.
Variables have the following definitions:
X_2 = National income (GNP at market prices), billions of U. S. dollars
X_{40} = Index of OEEC, food import prices (1953 = 100)
X_{50} = Composite food imports (SITC Sections 0 + 1 + 4) from U. S.
X_{51} = Total exports (SITC Section 0-9) to the U. S.
X_{62} = Ratio of U. S. to Canadian wholesale prices of farm commodities (1953 = 100)
[b] Numbers in parentheses beneath the regression coefficients are their respective standard errors.
[c] Coefficient differs significantly from zero at the 5-percent probability level.

posed a less serious problem than in others presented in Table 1, it is hard to know just how much OEEC food imports increased with rising exports to the United States, and how much they were affected by other, economic or non-economic factors not allowed for in the analysis.

In this context one of the questions to be resolved is the apparent efficacy of relative prices (X_{62}) as food import allocating devices. The impression imparted by the coefficient associated with X_{62} in equation 3 conforms well to what might be expected *a priori*: that disparity in the rate and direction of change between U. S. and Canadian farm commodity prices will call forth corresponding shifts in the magnitude of imports derived from these two sources. Yet empirical evidence does not provide a satisfactory proof that U. S. food shipments to Europe benefited from a generally more favorable relative price position. Actually for the period as a whole, Western European food imports from both the United States and Canada traced a highly cyclical and in most cases a parallel course and the magnitude of both declined below that transacted in 1951.[9] Furthermore, import controls, bilateral trading arrangements, and foreign exchange regulations effectively denied the functioning of the price mechanism in the regional distribution of Western European food imports in the period under consideration. The most that can be said is that while the coefficient of X_{62} appears reasonable, it is not adequate for broad generalizations and, on the whole it seems to overstate the importance of price movements on food import patterns.

The elasticity measurements presented in Table 2, rows a_2 and b_2, except those relating to intra-OEEC food imports (X_{38}), were derived from the logarithmic counterparts of equations 1 and 3 discussed above and shown in Table 1. The nature and scope of their statistical bias are similar to those of the net regression

[9] See Schmidt, The Impact of Western European Integration on U. S. Exports: Part II, p. 7, Table 4.

Table 2. — OEEC Composite Food Imports (SITC Sections 0 + 1 + 4) From the United States: Estimates of Import-Expenditure Elasticities With Respect to Selected Economic Variables, 1951-1960

Type of data[a]	Effect on OEEC imports of a 1-percent change in[b]				
	X_2	X_{38}	X_{40}	X_{51}	X_{62}
a_1	0.36	....	−1.39	0.28	−5.23[c]
	(0.34)		(0.74)	(0.24)	(2.23)
a_2	−0.35[d]	0.21[f]	−2.10[d]	0.05[e]	−4.05[e]
	(0.57)	(0.39)	(1.38)	(0.23)	(2.27)
b_1	1.10[c]	....	−2.09[c]	0.43	−5.78[c]
	(0.44)		(0.64)	(0.20)	(2.00)
b_2	0.17[d]	0.33[f]	−1.85[d]	0.24[e]	−4.25[e, c]
	(0.75)	(0.24)	(1.25)	(0.17)	(1.74)

[a] Where: *a* refers to coefficients obtained from analyses based on current value data expressed in logarithms and *b* refers to coefficients obtained from analyses based on constant (1953) value data expressed in logarithms. Subscripts 1 and 2 denote gross and net coefficients, respectively.
X_{38} = Intra-OEEC composite food imports (SITC sections 0 + 1 + 4) in millions of U. S. dollars.
For definition of other variables see Table 1, footnote a.
[b] Numbers in parentheses beneath the coefficients are their respective standard errors.
[c] Coefficient differs significantly from zero at the 5-percent probability level.
[d] Based on coefficients obtained from the logarithmic equivalent of equation 1, Table 1.
[e] Based on coefficients obtained from the logarithmic equivalents of equation 3, Table 1.
[f] Based on equations: $\underset{(0.39)\ (2.16)}{\text{Log } X_{50} = -0.45 + 0.21 \log X_{38} - 3.65 \log X_{62}} \quad R = 0.70$

$\underset{(0.24)\ (1.64)}{\text{Log } X_{50} = -0.53 + 0.33 \log X_{38} - 4.51 \log X_{62}} \quad R = 0.86$

coefficients estimated from the arithmetic values of economic variables.

Net elasticities in each case were considerably lower than the corresponding gross elasticities. The difference was especially wide for national income (X_2). It ranged from −0.35 to 1.10. In terms of the only statistically significant coefficient, a 1-percent rise in OEEC national income would be associated with about a 1.1-percent increase in food imports from the United States, disregarding the effects of other factors.

The analytical relevancy of this coefficient, however, must be questioned on both statistical and economic grounds. First, as a proxy for other associated trend factors, this coefficient mirrors the interaction of a multitude of diverse influences and thereby contains an upward bias. Further, the value of the coefficient stands at variance with the estimates arrived at in a recent study of demand for foodstuffs in Europe in 1965 prepared jointly by the Economic Commission of Europe (ECE) and the Food and Agriculture Organization of the United Nations (FAO).[10] Moreover, the comparison of the commodity structure of Western Europe's food imports from the United States with progress in nutritional standards and in the degree of self-sufficiency in products for which the quantity elasticity of demand tends to decline with rising incomes suggests a rather low overall income-import expenditure responsiveness.[11] For these reasons the net income elasticity coefficient of 0.17 and the gross coefficient of 0.36 would be less objectionable were it not for their large standard errors.[12]

[10] See Schmidt, The Impact of Western European Integration on U. S. Exports: Part II, p. 4, Table 2.

[11] Mimeographed tables showing the commodity composition of OEEC food imports from the U. S. and trends in consumption levels of selected food items in Western Europe (Univ. Ill. Dept. Agr. Econ. AERR-60) are available from the author.

[12] This is not to say, however, that there is no difference between the quantity and value elasticity of food consumption. It has been shown that the magnitude of the former is considerably lower than that of the latter. On this point see L. Goreux, Income Elasticity of the Demand for Food, AGRI/WP. 7/2, ECE/FAO, Geneva, 1959.

Even though their particular values are statistically unreliable, the fact that all coefficients for total exports (X_{51}) are low and positive is of significance. The size of these coefficients tends to support in part the inferences drawn from the national income analysis that food, imported or domestic, shares, but less than proportionately, in regional economic growth. Apart from the causal chain of interdependence between exports, national income, and imports, the export coefficients essentially show how a given supply of foreign exchange becomes distributed among various food and nonfood commodity categories.[13] It is relevant to note here that the expansion of Western Europe's imports from the United States in the 1950's, rendered possible by a rise in exports and augmented foreign exchange reserves, was concentrated on manufactures at the expense of foods and certain raw materials, notably fuels.[14]

The estimated elasticities of food imports with respect to the level of intra-OEEC food trade (X_{38}) are presented in Table 2. The fact that food imports from the United States failed to increase in line with those derived from intra-OEEC sources conforms well with what might be expected from the almost universal improvement in the degree of self-sufficiency and other developments elaborated above. In view of these considerations, however, the implications of the positive sign of these coefficients need further exploration.[15] Without an assessment of underlying commodity structures, it remains a matter of speculation whether and to what extent the relationship between food imports from the United States and those from intra-OEEC sources can be plausibly defined as complementary (positive coefficient) rather than competitive (negative coefficient).

Elasticity coefficients with respect to food import prices (X_{40}) ranged from −1.39 to −2.10 (Table 2). However, only the gross elasticity based on constant-value data, −2.09, differed significantly from zero at the 1-percent probability level. Although the coefficient signifies a marked sensitivity of food imports to variations in food import prices, by virtue of its aggregative nature, the coefficient presumably overstates the magnitude of responsiveness. Indeed, when allowance is made for the effect of other factors such as national income (X_2) or total exports to the United States (X_{51} in equations 1 and 2, Table 1), the analyses yielded coefficients which because of the size of their standard errors lack statistical acceptability. Once again the pronounced intercorrelation between these three independent variables prevents a reliable apportionment of their effect on the level of food imports procured from the United States.[16]

While there is evidence of a significant negative relationship between food

[13] For a comprehensive exposition of the relation between foreign factors and national income see J. J. Polak, *An International Economic System,* The University of Chicago Press, Chicago, 1953, Chapters 2-3.

[14] This issue will be considered in its wider aspects in a follow-up study entitled "Western European Raw Material and Manufactures Import Propensities and Elasticities."

[15] The elasticity coefficient (based on constant-value data) pertaining to intra-OEEC food imports has been estimated by the following equation:

$$\text{Log } X_{50} = -0.53 + \underset{(0.24)}{0.33} \log X_{38} - \underset{(1.64)}{4.51} \log X_{62}$$
$$R = 0.86$$

Simple correlation coefficients between the dependent and independent variables were 0.68 and −0.82 and the degree of intercorrelation between the independent variables themselves was −0.56.

[16] For example, the correlation between X_2 and X_{40} when equation 1b was expressed in logarithmic form ($r = -0.83$) exceeded their simple correlations with food imports (0.66 and −0.75).

imports and the ratio of U. S. to Canadian wholesale prices of farm commodities (X_{62}), both gross and net elasticity coefficients are so large that their economic relevancy must be questioned (ranging from −4.03 to −5.78). It should be mentioned, however, that intercorrelation was a less serious problem in this than in other analyses discussed above.

Regional Import Expenditure Elasticities[17]

The reigning economic, institutional, and random forces which have acted upon food imports obtained from the United States have also, though to a markedly different extent, been reflected in the experience of most other sources of supply. Apart from analytical biases referred to earlier, interpretational complexities are magnified by regional diversity in commodity structures. To the extent that import flows emanating from any particular region are not of a homogeneous commodity structure, interregional comparison of responsiveness to common economic stimuli may be neither conclusive nor meaningful. Even though a comparative assessment of behavior patterns is necessarily approximate, the elasticity coefficients presented in Table 3 should afford a broad idea of the importance of selected economic factors in the regional distribution of food imports.

Examination of these coefficients suggests the following general conclusions:

1. The order of magnitude of responsiveness of food imports to changes in national income shows considerable variation from one region to another. The

[17] The import-expenditure estimating relationships complementary to the elasticity coefficients presented in Table 3 are available in mimeographed form in AERR-60 upon request to the author.

Table 3. — Composite Foods (SITC Sections 0 + 1 + 4): Estimates of Regional Import-National Income Expenditure Elasticities, 1951-1960

(Percent change in OEEC imports with a 1-percent change in OEEC national income)

Area of origin	Type of data[a]	Elasticity[b]
World	a	3.51 (2.33)
	b	1.33[c] (0.16)
	a*	0.46[c] (0.13)
	b*	1.44[c] (0.21)
Intra-OEEC	a	0.75[c] (0.18)
	b	1.62[c] (0.17)
	a*	0.74[c] (0.17)
	b*	1.76[c] (0.13)
Eastern Europe	a	−0.77 (0.60)
	b	−0.41 (1.02)
European sterling area	a	0.64[d] (0.22)
	b	1.29[d] (0.40)
Asia	a	0.70 (0.30)
	b	1.55[c] (0.43)
OEEC excluding EEC and European sterling area	a	0.76[d] (0.22)
	b	1.73[c] (0.33)
Oceania	a	0.35 (0.16)
	b	0.86[d] (0.30)
South America	a	0.56[d] (0.21)
	b	1.20[d] (0.37)

[a] Where: *a* refers to coefficients obtained from analyses based on current value data expressed in logarithms, and *b* refers to coefficients obtained from analyses based on constant (1953) value data expressed in logarithms.

[b] Numbers in parentheses beneath the regression coefficients are their respective standard errors.

[c] Coefficient differs significantly from zero at the 1-percent probability level.

[d] Coefficient differs significantly from zero at the 5-percent probability level.

* Coefficient obtained from analyses based on per capita import and national income data.

extreme values of coefficients relating to composite food imports based on deflated data range from —0.41 for Eastern Europe to 1.76 for Intra-OEEC. The striking divergencies in the degree of import responsiveness may, in part, reflect differences in commodity structures, and in part be attributable to the level of aggregation.

2. Confrontation of elasticity estimates obtained for the United States (Table 2) with those pertaining to alternative import sources confirms the observation already made that foods produced in this country benefited less in Western Europe's expanding market than foods produced by competitors of the United States.

3. No conclusive statistical evidence of an effect of either import or export prices on food import patterns could be discerned in the analyses.

Conclusions

Western European food imports, especially those obtained from the United States, were influenced principally by (1) progress in nutritional standards, (2) gains in the degree of self-sufficiency, (3) maintenance of import-restraining policies, and (4) random, weather-induced fluctuations in the availability of indigenous supplies. The combined effect of these developments not only vitiated the import allocating efficacy of international price mechanism but at the same time also reduced the expansionary impulse associated with high and rising national incomes. All things considered, continuation of developments related to nutritional standards, self-sufficiency, and import-restraining policies leave relatively little scope for further expansion of American food exports to Western Europe in years to come.

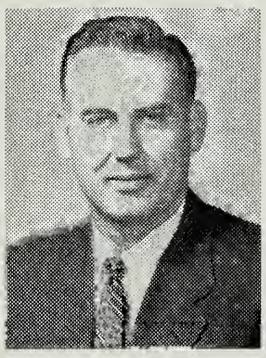
A subsequent article in Illinois Agricultural Economics *will present the import propensities and elasticities of the separate categories of food, beverages and tobacco, and oils and fats.*

CONTRIBUTORS TO THIS ISSUE

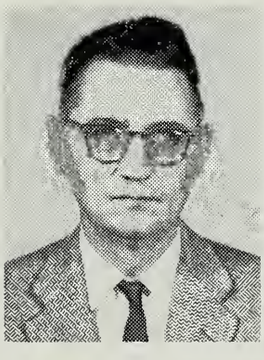
R. E. WEST during his graduate study became interested in the economics of fertilizer use in connection with his intention to operate a commercial farm. Since receiving his M.S. degree in agricultural economics at Illinois in 1962, he has operated a grain and hog farm near Farmer City, Illinois.

R. D. MILLICAN is Associate Professor of Marketing in the College of Commerce and Business Administration. His research is primarily in the fields of consumption economics and consumer markets. His studies in recent years have been concerned with functional relationships between family characteristics and expenditures, and his article in this issue reports a part of one of these studies.

R. G. F. SPITZE is engaged in teaching, research, and extension work. A graduate of the University of Wisconsin, he was on the staff of the University of Tennessee prior to joining the Department of Agricultural Economics at Illinois. His areas of interest are agricultural policy, agricultural finance, and economic development. He is currently teaching a course in agricultural policy.



N. G. P. KRAUSZ teaches courses in agricultural law and farm taxation. He has recently returned from Cyprus, where he spent four months drafting legislation for the use of water in that country. In addition to his investigations of water law, he conducts research in estate planning, zoning, taxation, and other areas in which legal aspects are important for agriculture.



S. C. SCHMIDT received his early education at the University of Budapest and his Ph.D. degree from McGill University. Prior to coming to the University of Illinois, he was on the staff at the University of Kentucky and at Montana State College. His research is concentrated in the area of international trade.

UNIVERSITY OF ILLINOIS
AGRICULTURAL EXPERIMENT STATION
Urbana, Illinois
Free — Publication · Permit No. 1114 · 5M
LOUIS B. HOWARD, Director

ILLINOIS AGRICULTURAL ECONOMICS is published semiannually by the Department of Agricultural Economics of the Illinois Agricultural Experiment Station. Louis B. Howard is Director of the Station, and M. B. Russell is Associate Director. Harold G. Halcrow is Head of the Department of Agricultural Economics.

This periodical reports studies carried on by members of the Department. Material appearing here may be reprinted, provided meaning is not changed, no endorsement of a commercial product or firm is implied, and credit is given to the author and this issue of Illinois Agricultural Economics.

To receive the publication regularly, write to the editor, Earl R. Swanson, Department of Agricultural Economics, University of Illinois, Urbana, Illinois. There is no charge.